January 2021

TECHNIQUES TO DETECT NEARBY WORKERS AND ALLOW INTERACTIONS THROUGH ASSET TRACKING SYSTEMS FOR SENSOR FAILURE SCENARIOS

Shridurgha Janakiraman

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AUTHOR:
Shridurgha Janakiraman

ABSTRACT

In industrial Internet of Things (IoT) environments, assets are often remotely tracked and/or monitored to prevent early wear and tear, misplacements, etc. Typically, sensors are attached to assets to facilitate remote monitoring. However, sometimes these sensors can stop communicating or responding to remotely triggered commands and a human may be needed to interface with such assets. Provided herein are techniques in which sensor failures may trigger an asset tracking system to recognize and identify workers in a close proximity in order to use any information from the workers to substitute in the place of missing information and/or to initiate real time communications within the system in order to address one or more asset issues.

DETAILED DESCRIPTION

In industrial IoT environments, assets are often remotely tracked and/or monitored in order to prevent early wear and tear, misplacements and etc. Typically, asset condition is remotely monitored by Operational Technology (OT) users through sensors that are attached to assets. These assets can be either stationary (e.g., inside factory premises) or mobile. In some instances, sensors attached to assets may stop communicating and/or may not respond to remotely sent commands due to various communication issues such that human interference with an asset may be needed.

For example, Low Power Radio Wide Area Network (LoRaWAN) sensors may enter an 'Offline' status when a gateway is not reachable, when signal interferences/disruptions occur in the surrounding area, and/or when there is an improper positioning of a sensor. In such scenarios, an associated asset (to what the sensor is attached) enters an 'Unknown' status, which can be a serious concern for OT users remotely monitoring the asset (e.g., thru an Internet application, etc.). In some instances, such a condition can extend for several hours.

Consider an example in which an asset is moving and a Global Positioning System (GPS) sensor attached to the asset goes out of the LoRaWAN gateway's radar. For example, if a transport vehicle's driver takes a wrong route, the asset's current location will be unknown for OT users.

Consider another example in which an asset is inside a factory floor and the instrument's machine temperature indicated as 'High' but the sensor attached to the asset does not respond to any 'Downlink' messages to control the temperature to be within acceptable thresholds. An immediate realization of this condition and action upon the condition is necessary in this case to prevent further damage to the equipment.

In the above example scenarios and as generally illustrated in Figure 1, OT users monitoring asset conditions will tend to troubleshoot the problem and it is often important to address such issues quickly. When the problem of a sensor results in a 'non-reachable' issue with a LoRaWAN gateway, it is difficult to rectify the issue without human support.

Figure 1: Example LoRaWAN Environment

However, if an asset tracking system could detect such situations, provide the ability to sense and identify workers near an asset, and enable real time communications thru the application itself, it could help to quickly solve such issues, as generally illustrated in Figure 2.

Figure 2: Allow Remote Users to Interact with Worker's in an Asset's Vicinity

In work environments, it is common to perform employee tracking and monitoring through a Real-Time Location System (RTLS) using various techniques. For example, BlueTooth® Low Energy (BLE) is typically used for real-time indoor location tracking and solutions herein are explained using this technique.

Consider, with reference to Figure 3, the following steps that may be utilized to realize techniques of this disclosure.

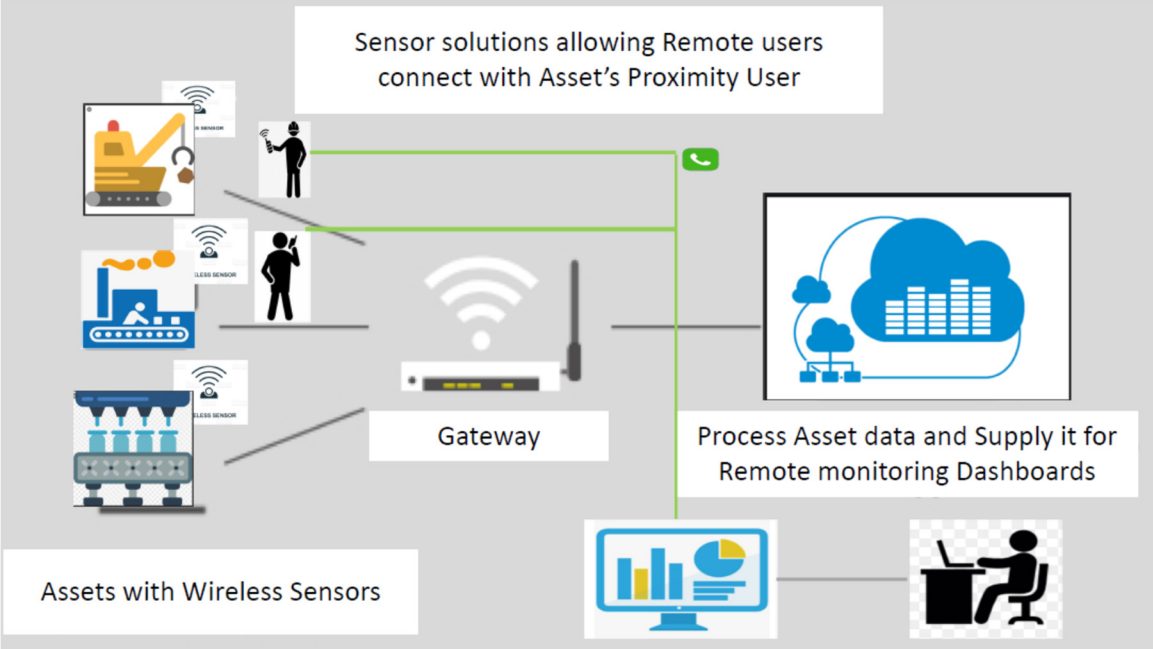

Figure 3: Solution Overview

Step 1: Recognizing a sensor non-reachability condition

Several techniques may be utilized to determine whether a sensor non-reachability condition is occurring. For example, if gateways added to the system are in a good condition, other sensors are able to communicate well thru the gateways, and if a given sensor battery condition is found to be "Good" when it communicated a previous time, this could be a condition that a given sensor is experiencing a non-reachability condition. In another example, if a LoRaWAN sensor has entered an 'Offline' status in this situation, it could be due to the fact that the gateway is not reachable.

Step 2: Detecting people near an asset's location

Once it is determined that a sensor may be in a non-reachability condition, it can be determined whether people are in the spot/area of the asset's location. In various examples, Bluetooth® beacons can be attached to assets, storage rooms, vehicles, factory floors, etc. for tracking workers and assets. In some instances, if the work environment allows using personal cell phones, a mobile application running in workers' cell phones can be utilized to collect information to determine which worker is closest to which asset(s) and send this information to asset tracking systems.

If a work environment does not allow using phones, Bluetooth beacons attached to employee badges can be used to detect the movement and positioning of workers and this location data can be uploaded to asset tracking systems

Step 3: Selecting an appropriate worker to address an asset issue

If there are more people near the asset, this solution further involves selecting the appropriate worker based on job role and/or relevance to the concerned asset. For an asset on the move, workers with job roles such as the vehicle's driver or shipper are more suitable to be called by remotely monitoring users. Conversely, for an asset on a factory floor, workers with job roles such as supervisors, machine operators, and/or the like may be more suitable. For example, Figure 4A illustrates an example in which a driver may be selected for a mobile asset and Figure 4B illustrates an example in which a supervisor may be selected for an asset on a factory floor.

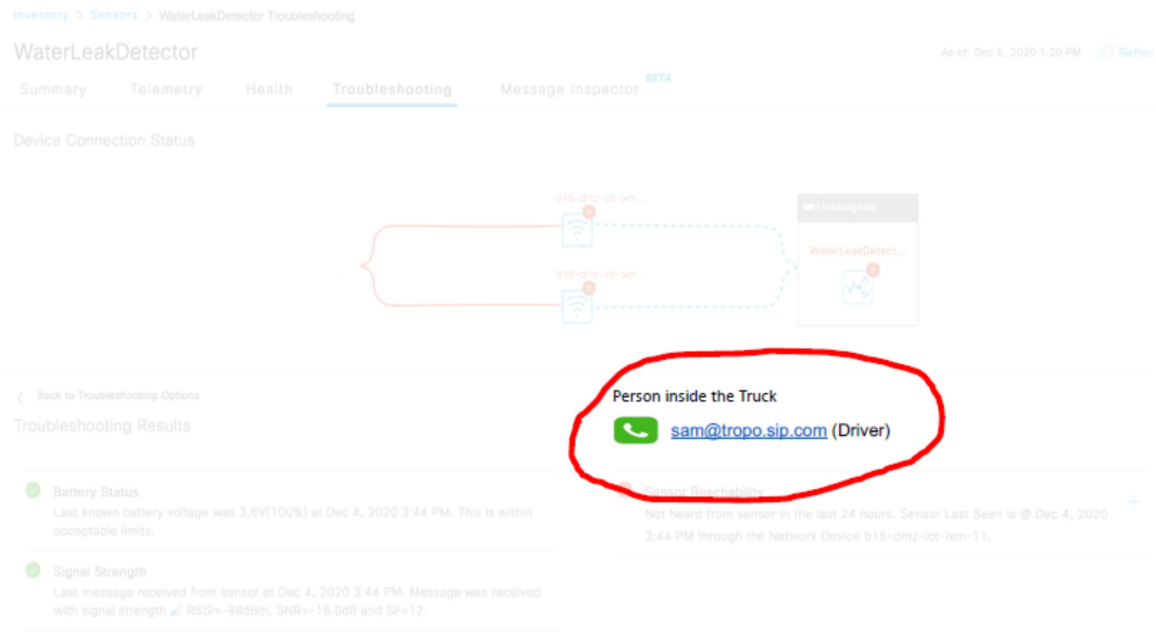

Figure 4A: Driver Selected as Person Closest to Asset on the Move

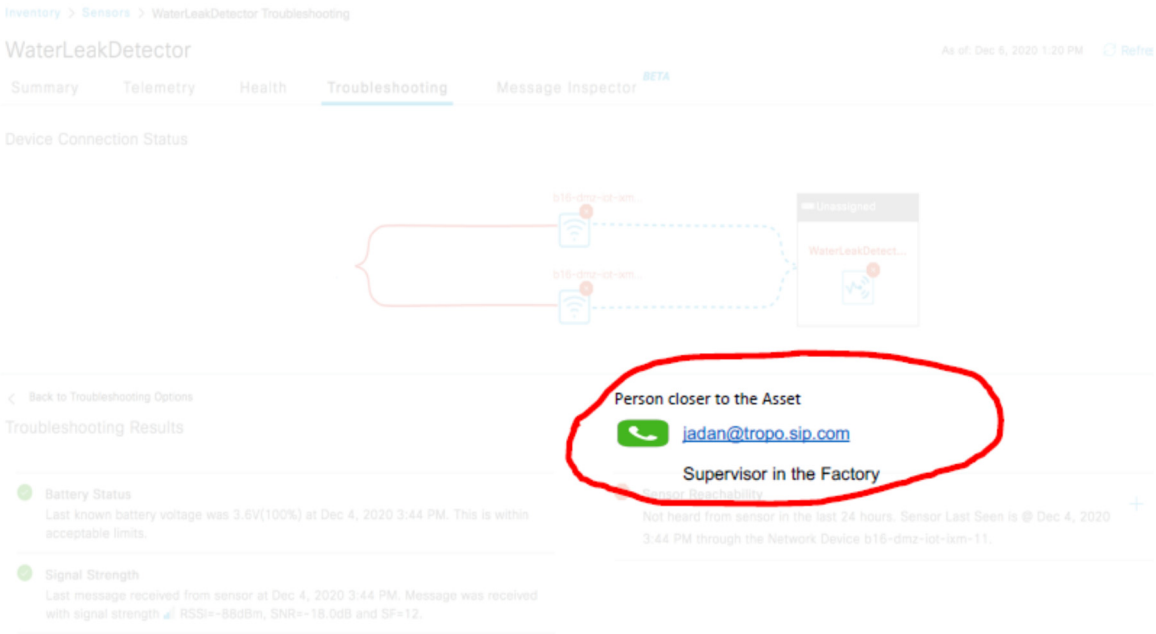

Figure 4B: Factory Floor Supervisor Selected as Person Closest to Stationary Asset

In some instances, in the absence of being able to track worker location, the system may skip Step 2, as discussed above, and retrieve worker data directly, as described in Step 3, to select an appropriate worker based on the asset's relevance to one or more worker(s).

Step 4: Providing communication with a selected worker

Once contact information is retrieved for a worker, the system may provide a link allowing an OT end user to contact the worker over phone via web application in order to inquire and instruct the worker regarding further actions related to asset.

For example, in one instance (e.g., corresponding to the example illustrated for FIG. 4A), the asset tracking system may provide a prompt with the message such as, "Supervisor A is standing next to Asset B, Do you want to contact to check on the "temperature" high issue?" In another instance (e.g., corresponding to the example illustrated for FIG. 4B), the asset tracking system may provide a prompt with a message such as "Driver X is on the vehicle where in asset is on the move, Do you want to call to check where the vehicle is now?"

In these cases, remote OT users might instruct a given worker to switch off the machine with High temperature issue for some time, ask the driver change a route, and/or any other instruction that helps to rectify the non-reachability condition.

Step 5: Optional call recording

In some instances, an optional call recording can be utilized by the system so that one or more users may be informed as to the progress of the communication(s)/issue(s) currently being handled. Thus, the asset tracking system may enable connecting the relevant people for an issue to facilitate collaboratively solving a problem.

In summary, as discussed herein, various sensor failures may be utilized to trigger an asset tracking system to recognize and identify workers in a close proximity in order to use any information from workers to substitute in the place of missing information and/or to initiate real time communications in order to address one or more asset issues.